DEVELOPING VALUE CREATION FRAMEWORK FOR MALAYSIA'S ALUMINIUM RECYCLING INDUSTRY FROM CONSTRUCTION PERSPECTIVE

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DEDICATION

I dedicate this thesis to

Almighty ALLAH S.W.T,

My beloved late father (Rakiman Bin Bagong), beloved late mother (Mariah Binti Ratmin) and siblings,

For your love, care and encouragement.

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ABSTRACT

Understanding on how value is created in certain product, service or firm is a precious knowledge. Value chain analysis is an original framework to explain value creation. But certain product or service could not be explained by this framework as it is more suitable for manufactured product. Nowadays aluminium is replacing steel in many of our daily products and it is an indefinitely recyclable item. The aim of this research is to develop a framework to explain value creation in aluminium recycling industry. Eight (8) case studies were selected which represents the actors in the aluminium recycling value chain. Respondents were from the construction site, metal collectors and many more. From these case studies, the activities which create value in the aluminium recycling value chain had been identified. The activities can be divided into primary and supporting activities. Primary activities are the activity which directly affects the value of the aluminium in the recycling chain. While supporting activities are the activities which affect the primary activities in value creation. However, the activities of aluminium recycling value creation are not similar as in the value chain analysis. Most notably recycling does not have marketing in the value creation framework. Moreover, aluminium recycling value creation framework has prerequisite factor which allows primary and secondary activities to work together to create value. The prerequisite factor consists of quality, quantity and government policy. This understanding may help the recycling industry in general to be more competitive. Highlighting the value aspect into recycling will result in environmental awareness no longer seen as a good deed only but as a promising business that can't be ignored. The knowledge on the value creation from the recycling process can attract ventures and investment towards the recycling activity.

ABSTRAK

Pemahaman tentang bagaimana nilai terbentuk dalam produk, perkhidmatan ataupun firma adalah ilmu yang amat bernilai. Analisis Rantaian Nilai adalah rangka kerja asal untuk menerangkan pembentukan nilai. Walaubagaimanapun sesetengah produk ataupun perkhidmatan tidak mampu dijelaskan melalui rangka kerja ini memandangkan ia lebih sesuai untuk produk perkilangan. Masa kini, aluminium menggantikan besi dalam kebanyakan produk harian dan ia adalah bahan yang boleh dikitar semula tanpa had. Tujuan kajian ini adalah untuk membentuk sebuah rangka kerja untuk menerangkan pembentukan nilai dalam industri kitar semula aluminium. Lapan (8) kajian kes telah dipilih yang mewakili entiti dalam rantaian nilai industri kitar semula aluminium. Responden yang terlibat adalah dari tapak pembinaan, pengutip logam dan sebagainya. Daripada kajian-kajian kes ini, aktiviti-aktiviti yang membentuk nilai dalam rantaian nilai kitar semula aluminium telah dikenalpasti. Aktiviti-aktiviti ini terbahagi kepada aktiviti utama dan aktiviti sokongan. Aktiviti utama ialah aktiviti yang mempengaruhi nilai aluminium dalam rantaian nilai aluminium secara langsung. Manakala aktiviti-aktiviti sokongan ialah aktiviti yang mempengaruhi aktiviti-aktiviti utama dalam pembentukan nilai. Walau bagaimanapun, aktiviti pembentukan nilai kitar semula aluminium tidak sama seperti analisis rantaian nilai. Kebanyakan perniagaan kitar semula tidak mempunyai pemasaran dalam rangka kerja penbentukan nilai. Selain itu, kerangka pembentukan nilai kitar semula aluminium mempunyai faktor prasyarat yang membolehkan aktiviti utama dan sokongan berfungsi dan terdiri daripada kualiti, kuantiti dan dasar kerajaan. Ini menjadikan rangka kerja yang terbentuk adalah unik dan baru. Rangka kerja ini dapat membantu undustri kitar semula secara umumnya untuk menjadi lebih kompetitif. Menekankan aspek nilai dalam kitar semula akan menyebabkan kesedaran alam sekitar dipandang sebagai sebuah perniagaan yang menguntungkan serta mampu menarik pelaburan baru.

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LIST OF ABBREVIATIONS

VCA	-	Value Chain Analysis
VNA	-	Value Network Analysis
VSA	-	Value Shop Analysis
RMK-10	-	Rancangan Malaysia Ke-10
RMK-11	-	Rancangan Malaysia Ke-11
JPSPN	-	Jabatan Pengurusan Sisa Pepejal Negara
SWCorp	-	Solid Waste Corporation

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter is on the introduction of the research. This chapter compose of research background, problem statement, research questions, research objectives, research scope and research significance. The research background is brief information on value creation and aluminium recycling. The problem statement part shows issues on value creation and aluminium recycling. Then this chapter continues with the research questions and objectives from the aroused problem. Research scope part is on limitation of research. Lastly, the importance of conducting this research is in the research significance part.

1.2 Research Background

Today, aluminium is the most produced non-ferrous metals in the world (Dutta, Apujani, & Gupta, 2016). Over the years, global demand for aluminium and its product is increasing partially due to the corrosion resistance feature of the aluminium (Cui & Roven, 2010; Jirang & Hans, 2010). There are two sources which aluminium can be produced. The first one is the primary source and the second one is the secondary source. In the primary source, aluminium is produced from ore mineral known as bauxite (Schlesinger, 2014). The bauxite then go through the Bayer Process to produce pure aluminium (OECD, 2010). The secondary source of aluminium is through

aluminium recycling (Zimring, 2017). The production of aluminium from the primary source began in 1800 (Schlesinger, 2014). While only in 1939 aluminium started to be recycled (CEPA, 1997) as the second source of aluminium.

Aluminium recycling is defined as the treatment of aluminium scrap to produce new aluminium metal and alloys which frequently termed as secondary source of aluminium (Schlesinger, 2014). Aluminium is one of many materials that can be recycled. Among the materials that can be recycled are paper (Brodin & Anderson, 2008), metals (Stefan, 2008) and plastic (Brodin & Anderson, 2008) which is known as recyclable materials. Amongst all of these items, aluminium is the most recycled and most recyclable items in the current market (Akkucuk, 2016). Thus, aluminium is the third most abundant element on earth, forming eight (8) percent of the earth's crust (Godzimirski, 2017).

There are many advantages of aluminium recycling in comparison to the primary source of aluminium. One of the advantages of aluminium recycling is energy saving. Remelting aluminum scrap from recycling cut almost 95% of the energy required to manufacture pure aluminum from bauxite (Das, *et al.*, 2004; Das & Yin, 2007). Other than that, aluminium is light, strong and easy to recycle. Aluminium also possesses a unique quality which makes it stands out as a recyclable materials which is indefinitely recyclable (Schlesinger, 2014; TAA, 2016). Moreover, aluminium can be recycled and never lose its quality. The accumulation of these advantages leads to the use of aluminium in transportation, building, and electrical and machine tools (EAA, 2013).

According to UNEP (2010), aluminium stock in the developed country is in rise from daily and industrial usage and in need to be recycled. With the high demand and cumulating amount of aluminium around the world, aluminium is important and valuable in the recycling industry. Some nations with high developing rate quickly adopt recycling as a business. China is the country with highest aluminium recycling rate being followed by Europe and Japan (IAI, 2017). In 2017 alone, as much as 1,575,000 Metric tons of aluminium scrap had been recycled in China (IAI, 2017). China and Japan are both in the Asia continent as Malaysia. The high recycling rate of aluminium in many nations indicates aluminium is a promising business venture and being competitive is the way to remain on top of the game. This means for a developing

country like Malaysia, it needs to prepare a good recycling approach to recycle aluminium as Malaysia strives to be a developed country.

In 2011, Malaysia had invested RM2.3 Billion in aluminium manufacturing which are the base for manufacturing aluminium based products (MIDA, 2016). Thus, in Rancangan Malaysia Ke-10 (RMK-10) and Rancangan Malaysia Ke-11 (RMK-11) which both are Malaysia's national plan for economic growth, had mentioned on the development of aluminium based manufacturing industry (Unit Perancang Ekonomi, 2010; Unit Perancang Ekonomi, 2015). Considering the large sum of money invested in aluminium manufacturing, it is pointing to the increasing generation of the by product from aluminium manufacturing whether in the form of aluminium scrap or aluminium dross.

Both aluminium scrap and aluminium dross are input for aluminium recycling. Aluminium scrap is the by product from primary aluminium production. While aluminium dross is the by product from primary and secondary aluminium production (Petavratzi, & Scott, 2007). It is estimated about 5000 – 10000 tonnes of aluminium dross is generated per month in Malaysia (KAS Aluminium, 2017). Referring to the high number of aluminium dross, it is the reflection of the amount of manufactured and recycled aluminium which is a favourable condition for the aluminium recycling industry to grow in Malaysia.

Recycling had become a major issue not only in Malaysia but also many developing countries in the world. It is facing greater challenges in order to keep all of the waste in proper management (Budhiarta, Siwar, & Basri, (2012); Badgie, *et al.*, (2012); Muhaimin & Mat, 2013). Aluminium recycling is one of the major components of the aluminium industry. After years of being part of the aluminium life cycle, a chain of recycle has developed as part of the entire aluminium value chain which has yet to be adequately explained, (EAA, 2015). This can be referred in Figure 1.1. In each steps of the aluminium value chain, the process of creating value takes place. The same goes for recycling step where the value is created from the scrap instead of pure aluminium.

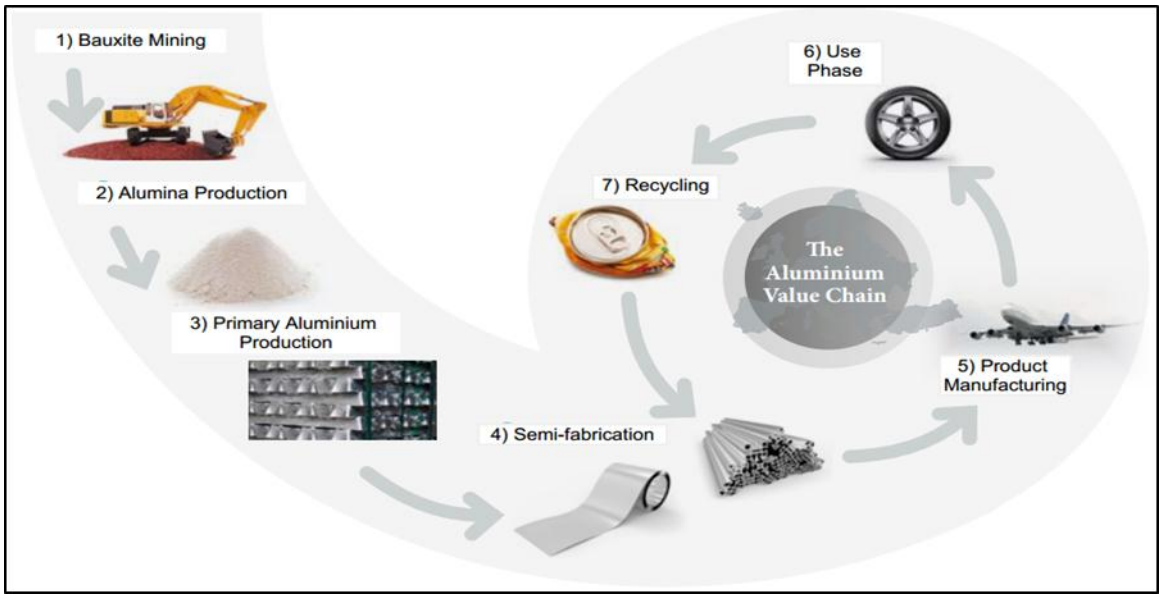

Figure 1.1: The Aluminium Value Chain. (EAA, 2015)

Although most people recognise recycling as a way to save the environment. At its core, recycling is not being run by environmentalist, but by people of business aiming for profit. This means that recycling exists as a business that at the same time saves the environment which constantly faces competition from other businesses. In order to remain producing profit, a business must create value to stay competitive (Porter, 1985). Aluminium recycling also faces the same process of creating value from turning scrap which is basically a waste back into pure aluminium (Schlesinger, 2014). Usually at the end of a product final life cycle, it will be discarded and called waste even if it still holds some value or not (EPA, 2009; EPA, 2015). But in the case of aluminium, the value from the aluminium scrap can be revived back through recycling.

Value creation is the process of which value is created in a product or a service. In order to understand how value is created, it must be analysed. There are only a few analysing model for value creation. The first model to analyse value creation is Value Chain Analysis (VCA) (Porter, 1985) which shed the understanding on how value is created in chain of activities. This analysis explains value creation in the manufacturing realm for product based businesses (Sheehan & Stabell, 2007). Later, two more models to analyse value creation follows, which are Value Network Analysis (VNA) and Value Shop Analysis (VSA) which are for service based businesses.

Stabell & Fjeldstad, (1998) argued that VCA is not adequate to explain about value creation in other ventures of businesses.

Other ventures of business apart of manufacturing also need its own model of value creation (Sheehan & Stabell, 2007). They agreed that the available business is too wide to be analysed only by the VCA. Then they came out with value configuration analysis which provided better understanding on value creation in other ventures of business such as oil and gas, internet purchasing and service which Porter's VCA could not explain adequately. VCA no longer stand alone as the sole analysing tool for value creation.

Value configuration analysis, Stabell & Fjeldstad, (1998), is the combination of three (3) models of value analysis to analyse value creation in different ventures of businesses which are VSA, VNA and VCA. Therefore, the value configuration analysis is basically a modification of the past value creation analysis model brought together and forwarded by (Stabell & Fjeldstad, 1998). But they admitted that the model is still not enough to cover all businesses available. It is not accurate to analyse value creation in all businesses available just by the three models of value creation analysis considering the vast variety of businesses. Since recycling is also a business, therefore, the concern of this research is the need to understand the value being created in the aluminium recycling value chain in order to have better knowledge on the industry to make any possible improvement in the future for it to remain as a competitive business.

1.3 Problem Statement

Malaysia is among the largest exporter of bauxite in the world, accounting for 26 % of the total global bauxite export in 2016 (OECD, 2016). In 2015, there are 25 bauxite mines in Malaysia. However, that number had suddenly decreased in 2016 to only 3 mines (Mineral and Geoscience Department of Malaysia, 2016). This has led to the decrease of global bauxite production by 11% owing to reduced production of 34 million tons from Malaysia (U.S. Geological Survey, 2017). Both the decrease in export and bauxite mines number are due to the ban imposed by the Malaysia's government on bauxite mining. The government of Malaysia banned bauxite mining since January 2016, to uphold to stricter environmental laws (U.S. Geological Survey,

2017). This showed that Malaysia strives for more environmental friendly approach in generating the economy because primary aluminium production has negative impact on the environment. Even though Malaysia had been ranked among the highest producer of bauxite but it never ranked itself in the top aluminium recycling countries in the world. North American region has led the aluminium recycling industry by having 4 of the top global aluminium recycling company in it (AlCircle, 2017). While in Asia, China and Japan still ranked as the top country to recycle aluminium (ABAL, 2017). The high aluminium recycling rate in Japan and China is partly due to the increased usage of aluminium in these countries. As Malaysia also had increased the investment in aluminium manufacturing since 2011 (MIDA, 2016), this means that aluminium scrap will also increase in number throughout the aluminium manufacturing process. This situation opens a path for secondary production of aluminium which is through recycling in Malaysia to replace the economic income that had been loss due to the ban of bauxite.

There is no denying that recycling is a global business, IAI (2017). In the era where sustainability is crucial, still there is yet a sufficient understanding or explanation on how value is created from waste or commonly known as recycling. This had clearly being mentioned by Brodin & Anderson, (2008), where they highlighted it is important to understand the value creation aspect of recycling. In the research, it is agreeable that recycling is valuable but how the value is actually created from recycling lacks explanation in term of the elements that creates value from recycling. Usually when an item is discarded, the value has reached its end which possesses none if not little value to the owner. The value is lost altogether or brought back via the recycling process. It is as if bringing back near dead or dead people to life. But what are the processes and dynamics that created back the value from aluminium scrap?

Furthermore Schlesinger (2014), highlighted that the driving force behind recycling is to generate profit and the value creation part of recycling is an important part of aluminium recycling. Among the benefits of aluminium recycling is, the recycling process only requires 5% of the total energy required for primary aluminium manufacturing (Das & Yin, 2007). This huge reduction in energy, means huge cost saving. Which means gaining profit by minimising the cost. But recycling creates value not only by cutting the cost in used energy. Even though efforts had been given in manipulating the way aluminium scrap is processed, which is the solid state of

recycling (Shamsudin, Lajis, & Zhong, 2016). The objective remains the same, which is to cut the cost of aluminium recycling by changing the way it is processed. By doing so, the energy usage can be cut, cost will be reduced and value can be created in minimising the cost. To focus only on processing aspect in order to create value is inadequate.

Even though Schlesinger (2014), had mentioned on the elements that affect the value creation in aluminium recycling are scrap grades, scrap prices, scrap purchasing and processing. But according to Porter, (1985), in order to create value in a business, there are nine (9) aspects to be considered. The aspects are "Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service are categorised as primary activities. Secondary activities include Procurement, Human Resource management, Technological Development and Infrastructure." (Porter, 1985).

Paying attention to scrap and process in order to create value is only two (2) out of nine (9) aspects of value creation because scrap falls under procurement and process falls under the operations aspect which is inadequate to fully create value in the business of recycling. Usually, Porter's framework of value creation fits well for manufacturing business. But there are a few factors that recycling differ technically in certain aspect from value creation in manufacturing. There are a few interrelated issue of value when it involves recycle item. The first one can be traced in Dahlstr¨om *et al.*, (2004) and Billy (2012) which partly dealt with the flow and monetary value of aluminium from the ore and stopped at the recycling as the end of life. Both of the researches described how the value of aluminium increased from its production from the ore which is bauxite to the creation of the final product such as cans and car, and lastly on recycling. In their researches, the manufacturing process started again without adequate explanation on the recycling processes which allows the aluminium enter the manufacturing cycle once again as input. Both did not explain what happen in the recycling processes and the value in it. Most notably, the actors in the manufacturing of aluminium is there to be explained, right from the producer, manufacturer and final customer. But when it arrived at the recycling stage, it is regarded as one actor or entity while the truth is, recycling is an industry that composed of a few actors on its own right. Who are the actors and where does it goes in this chain of recycling before it enters again into the manufacturing realm?

Secondly, recycle item such as aluminium rarely exist as its pure form. According to Dahlstr¨om *et al.*, (2004), aluminium recycling value chain is quite

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